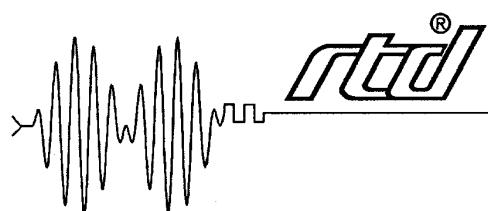


EPWR104HR Embedded PC/104 Power supply module

User's Manual



Real Time Devices, Inc.

"Accessing the Analog World"®

EPWR104HR

Power supply module

User's Manual

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Revision History

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21/08/1998	Addition regarding CE information of IDAN-EPWR104HR
04/01/1999	Addition on IDAN-EPWR104HR
25/08/2000	Small corrections to fuse information and input voltage range in manual
11/07/2001	Formatting
17/12/2001	EPWR104HR-3 added -5V output

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Declares that the following products:

IDAN-EPWR104HR, EPWR104HR-1, EPWR104HR-2

to which this declaration relates, is in conformity with the relevant EU directives:

EU EMC directive 89/336/EEC
EU Low Voltage directive 73/23/EEC

using the relevant section of the following EU standards and other normative documents:

EN50081-2: 1995 Emissions, generic requirements

EN55022 Measurement of radio interference characteristics of information technology equipment

EN50082-2: 1995 Immunity, generic requirements

- EN61000-4-3 Radio-frequency electromagnetic field, AM modulated
- EN61000-4-6 Radio-frequency common mode, AM modulated
- EN61000-4-2 Electrostatic discharge
- EN61000-4-4 Fast transients

Information supporting this declaration including a test report is available from Real Time Devices.

Tomi Hänninen, Managing Director

Helsinki 06.11.1998

Notice: We have attempted to verify all information in this manual as of the publication date.
Information in this manual may change without prior notice from RTD Finland Oy.

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Chapter 1 INTRODUCTION

This user's manual describes the operation of the EPWR104HR PC/104 high power density automotive input range power-supply unit

Features

Some of the key features of the EPWR104HR include:

- Wide input voltage range 8-40V DC
- 50Hz 24V AC input with minimal external components
- Parallel DC/DC converters for computer power and peripheral power
- 50W output power guaranteed **with adequate cooling**, minimum of 82% efficiency
- Power output options include:

EPWR104HR-1	+5V
EPWR104HR-2	2 x +5V, +12V
EPWR104HR-3	2 x +5V, +12V, -12V, +-15V , -5V
- Thermostat with two adjustable temperature trip points (Available only on -3F versions)
- Onboard fan unit (Available only on -3F versions)
- Status LED's: EPWR104HR-1 1 , EPWR104HR-2 3, EPWR104HR-3 5
- Standard floppy power output connector on all versions
- Fully PC/104 compliant
- EMC emissions compliant to EN55022 CIS-B (documents available)
- Extended Operating Temperature (-40 to +85 C) available, IDAN
- CE compliant in IDAN enclosure

The following paragraphs briefly describe the major features of the EPWR104HR. A more detailed discussion is included in Chapter 3 (Hardware description) The board installation is described in Chapter 2 (Board Installation).

Power supply units

The EPWR104HR automotive input power supply unit offers a complete reliable power subsystem for your sophisticated computer and its peripherals. To improve reliability in error conditions, the EPWR104HR is designed using two independent power supplies for the computer and the peripheral system components. This enables computer operation even though the display or motor power-supply unit fails.

The main +5V computer power supply is designed using a "Buck" connected switching regulator providing high output current (5A) with a high efficiency (>80%) under all conditions. The secondary peripheral power supply is designed from a +5V output "Buck" converter and +12V and -12V "Boost" converters in series. The +-15V (or optionally +12V) outputs are implemented using a 1W DC/DC converter from +5V.

Board Options

The EPWR104HR is available in the three main output configurations as set out below:

Option 1	EPWR104HR-1	+5V
Option 2	EPWR104HR-2	2 x +5V, +12V
Option 3	EPWR104HR-3	2 x +5V, +12V, -12V, -5V, +-15V

Options -3 is available with an onboard thermostat and fan subsystem. In this case the board is specified as follows: *EPWR104HR-3F*

Mechanical description

The EPWR104HR is designed on a PC/104 form factor. An easy mechanical interface to both PC/104 and EUROCARD systems can be achieved. Stack your EPWR104HR directly on a PC/104 compatible computer using the onboard mounting holes. Care must be taken to ensure adequate heat dissipation from the onboard heat sink in high output power configurations. **Note that the heat sink is connected to power supply ground!**

Connector description

The standard power connections are made using "cable plug" type terminal blocks. This enables removing connections from the board without opening the cables from the terminal blocks. A 4-pole "floppy type" connector is also available for easy wiring to PC peripherals. In the IDAN-EPWR104HR the connections are implemented using standard terminal blocks.

What comes with your board

Your EPWR104HR package contains the following items:

- EPWR104HR board
- Mating connectors for the supported power connections
- User's manual

If any item is missing or damaged, please call Real Time Devices Finland customer service department at the following number: (+358) 9 346 4538.

Using this manual

This manual is intended to help you install your new EPWR104HR module and get it working quickly, while also providing enough detail about the board and its functions so that you can enjoy full use of its features even in the most demanding applications.

When you need help

This manual and all the example programs will provide you with enough information to fully utilize all the features on this board. If you have any problems installing or using this board, contact our Technical Support Department (+358) 9 346 4538 during European business hours. Alternatively, send a FAX to (+358) 9 346 4539 or Email to sales@rtdfinland.fi. When sending a FAX or Email request please include the following information: Your company's name and address, your name, your telephone number, and a brief description of the problem.

Chapter 2 BOARD INSTALLATION

The EPWR104HR embedded power supply module is very easy to connect to your industrial or automotive control system. Direct interface to PC/104 systems as well as EUROCARD boards is achieved. This chapter tells you step-by-step how to install your EPWR104HR into your system.

Board Installation

Keep your board in its antistatic bag until you are ready to install it to your system! When removing it from the bag, hold the board at the edges and do not touch the components or connectors. Please handle the board in an antistatic environment and use a **grounded** workbench for testing and handling of your hardware. Before installing the board in your computer, check the power cabling. Failure to do so may cause the power supply unit to malfunction or even cause permanent damage.

General installation guidelines:

- Touch the grounded metal housing of your computer to discharge any antistatic buildup and then remove the board from its antistatic bag.
- Hold the board by the edges and install it in an enclosure or place it on the table on an antistatic surface.
- Install your board in your system, and wire the power supply correctly.
- Failure to do so may cause the power supply unit to malfunction or even cause permanent damage to the device.
- Check all wiring connections once and then once more again.
- Check the input power to the board is in the range of 8 to 40V DC.
- Apply power to your EPWR104HR, and make sure the diagnostic LEDs indicate correct operation.

Installation integrated with a PC/104 module stack:

- Secure the four PC/104 installation holes with standoffs.
- Connect the board to the power supplies using the power interface connectors.

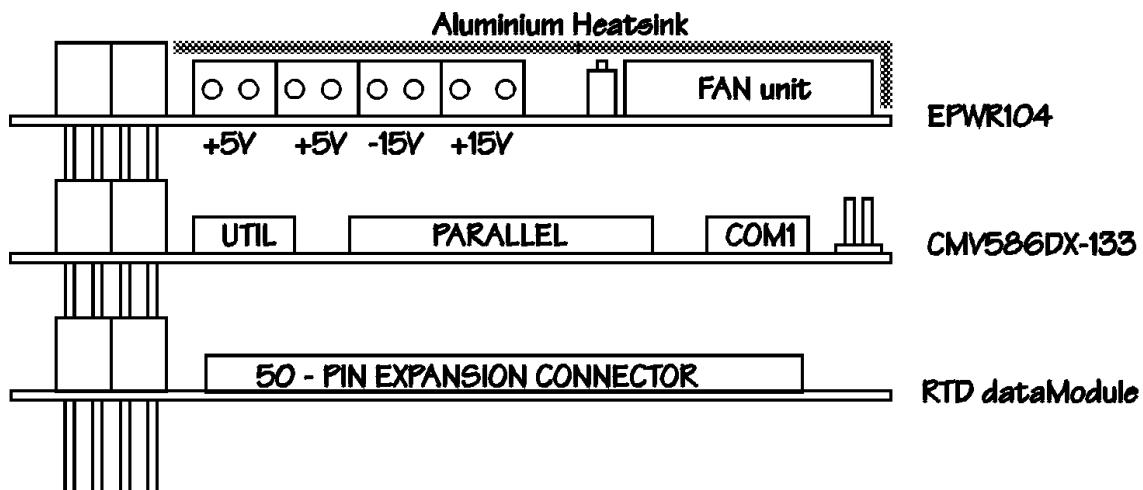


Fig. 1-1: EPWR104HR integrated in a RTD PC/104 cpuModule stack

Note: For full output power performance, install your EPWR104HR at the top of your PC/104 system and make sure adequate cooling is provided. You may increase airflow with the EFAN104 fan module from Real Time Devices.

3U rack or enclosure installation with a EUROCARD CPU and EPWR104HR.

The PC/104 system can easily be inserted into a 19" rack installation using the CPU as a "form factor adapter". Assemble your PC/104 data modules on a RTD single board EUROCARD computer and install the system in a 19" enclosure.

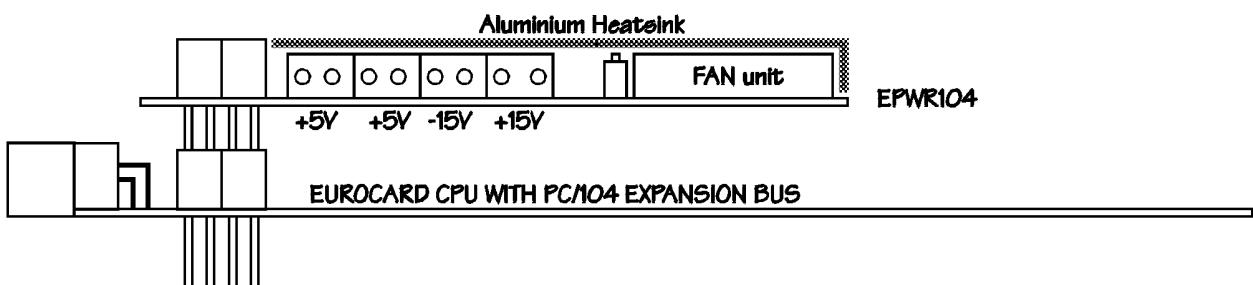


Fig. 1-2: 19" Eurocard rack installation with an EPWR104HR and an EUROCARD cpuModule computer

External Power Connections

The illustration 1-3a below indicates the power connections of the EPWR104HR-3F board.

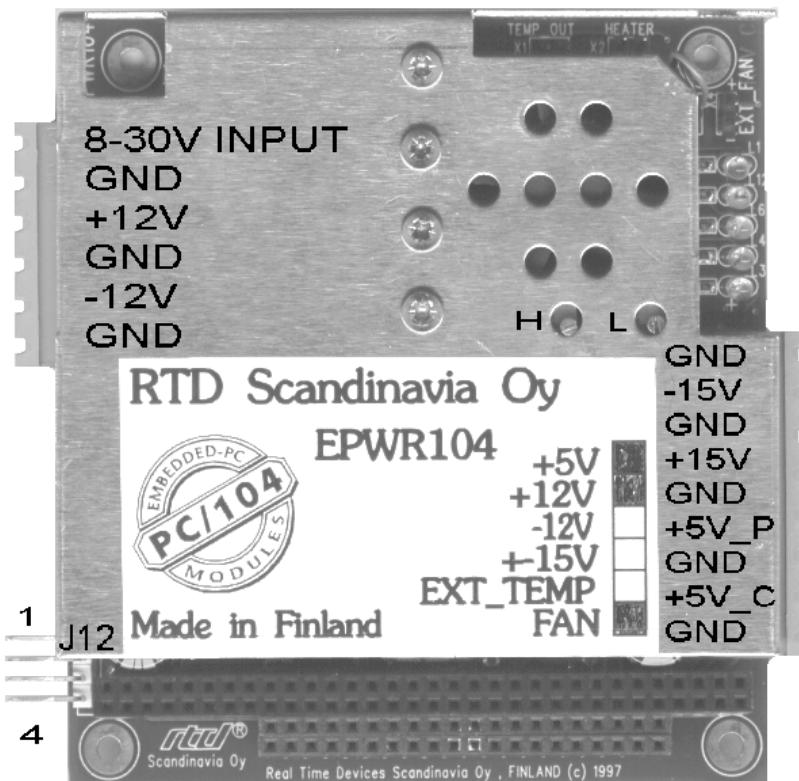


Fig. 1-3a EPWR104HR-3F power supply power connections

Connector descriptions:

- **J1:** Raw input power to the EPWR104HR-3F. Input voltage range is 8-40V DC.

Note: The input power of the module may be up to 60 W, this will require a cable wire diameter of 1,5 to 2,0 sq. mm. Make sure this input wire is kept as short as possible to reduce voltage drops and generated noise. Remember that the EPWR104HR will take up to 2x the normal current at startup. In case your power source can not provide this power (current) startup failure may occur.

- **J2:** Computer +5V supply, this power is also connected to the PC/104 bus.
- **J3:** Peripheral +5V supply, this powers all the other power supplies not on the PC/104 bus.
- **J4:** +12V output for peripherals
- **J11:** -12V output for peripherals
- **J9:** -15V 30mA from DC/DC converter
- **J10:** +15V 30mA from DC/DC converter
- **J12:** "Floppy type" power connector Pin#1 = 5V, Pin#2,3 = GND, Pin#4 = +12V

Outputs J4, J11, J9, J10 and J12 are from the peripheral converter. Note that the -5V is fed into the PC/104 bus only, there is no external connection!

The illustration 1-3b below shows the input and output power connections of the EPWR104HR-2 board.

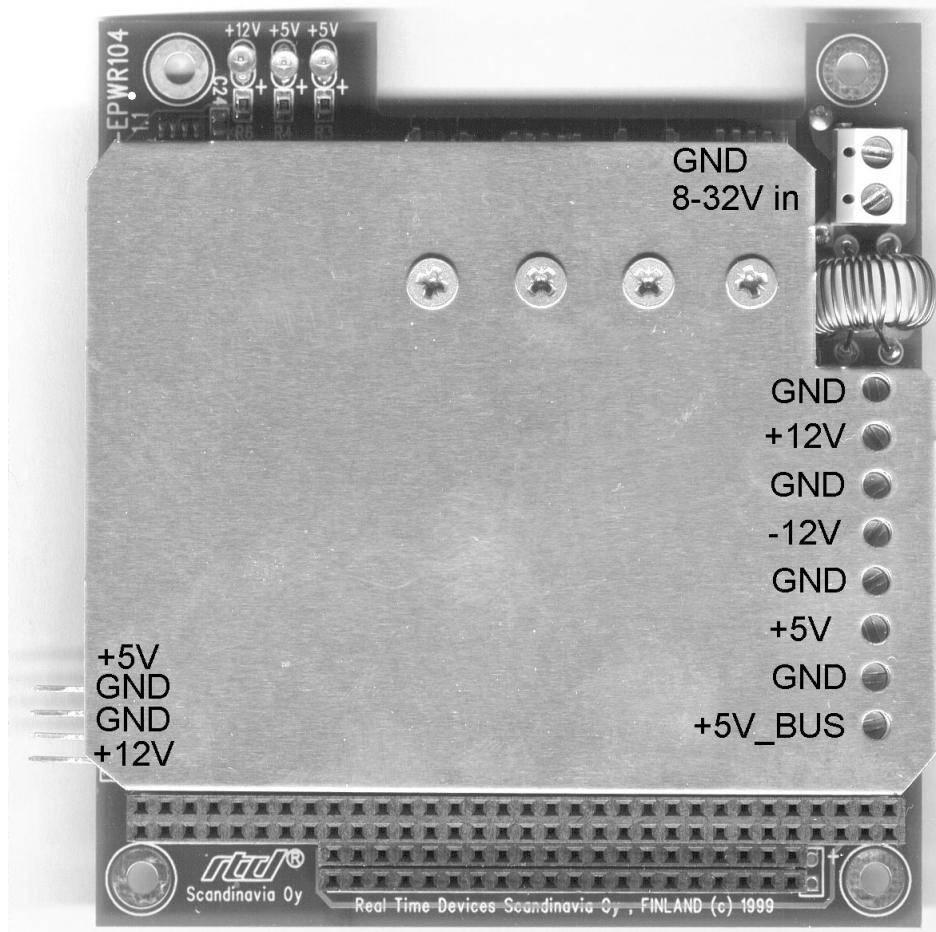


Fig. 1-3b EPWR104HR-2 power supply power connections

Connector descriptions:

- **J1:** Raw input power to the EPWR104HR-2. Input voltage range is 8-40V DC.

Note: The input power of the module may be up to 60 W, this will require a cable wire diameter of 1,5 sq. mm. Make sure this input wire is kept as short as possible to reduce voltage drops and generated noise.

- **J2:** Computer +5V supply, this power is also connected to the PC/104 bus.
- **J3:** Peripheral +5V supply, this powers all the other peripherals not on the bus.
- **J4:** +12V output for peripherals
- **J11:** -12V output for peripherals
- **J12:** "Floppy type" power connector Pin#1 = 5V, Pin#2,3 = GND, Pin#4 = +12V

Outputs J4, J11, J9, J10 and J12 are from the peripheral converter.

The illustration 1-3c below shows the input and output power connections of the EPWR104HR-1 board.

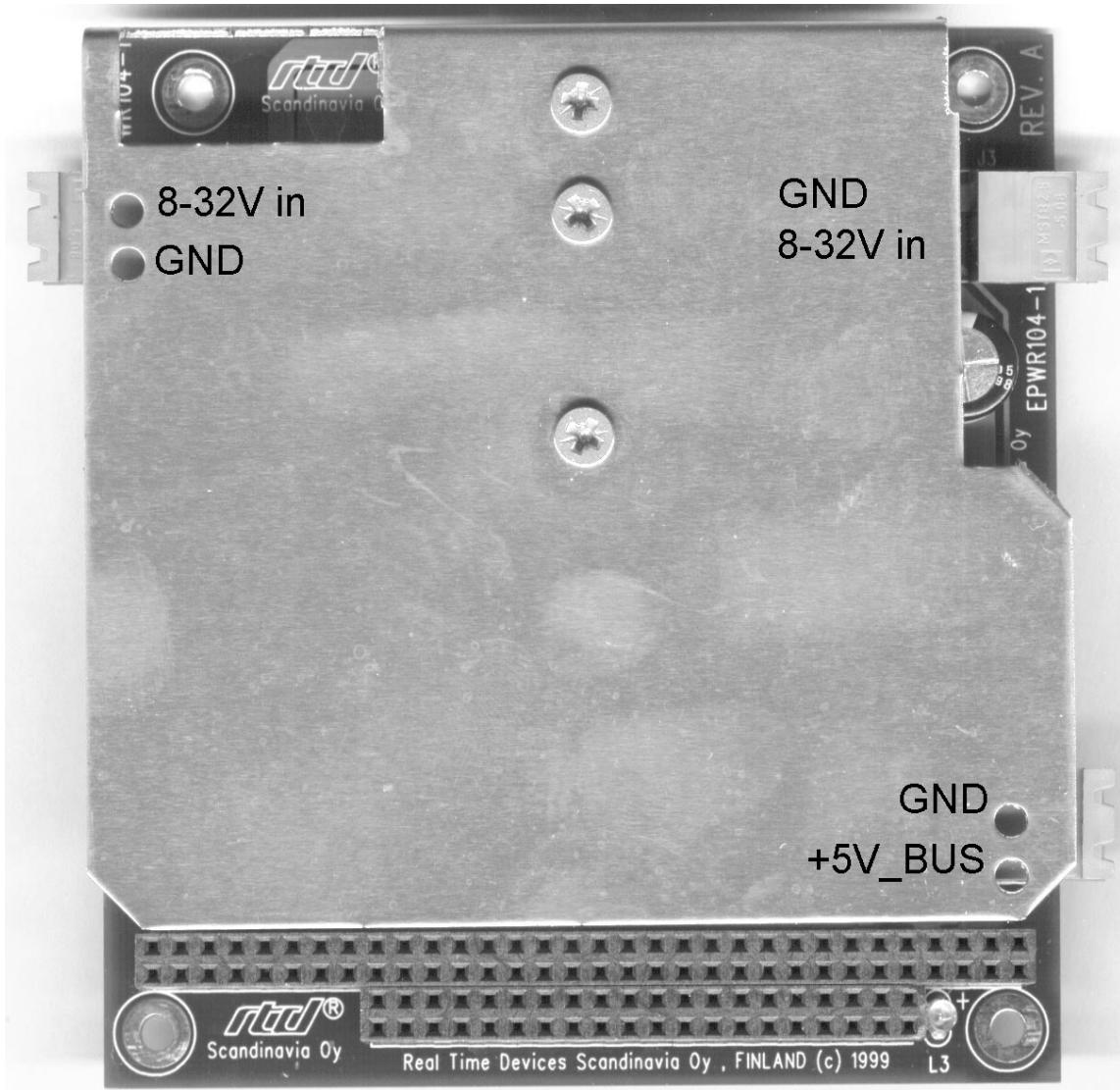


Fig. 1-3c EPWR104HR-1 power supply power connections

Connector descriptions:

- **J1:** Raw input power to the EPWR104HR-2. Input voltage range 8-32V DC.
- **J2:** Raw input power to the EPWR104HR-2. Input voltage range 8-32V DC, alternative input.

Note: The input power of the module may be up to 60 W, this will require a cable wire diameter of 1.5 sq. mm. Make sure this input wire is kept as short as possible to reduce voltage drops and generated noise.

- **J2:** Computer +5V supply, this power is also connected to the PC/104 bus.

Chapter 3 HARDWARE DESCRIPTION

This chapter describes the major features of the EPWR104HR, which are the following:

- Main +5V converter for computer
- Secondary +5V and +-12V converter for peripherals
- Optional auxiliary power outputs
- The functionality of the LED's.
- The onboard fan unit and thermostat (-3F model).
- Fuses and protection

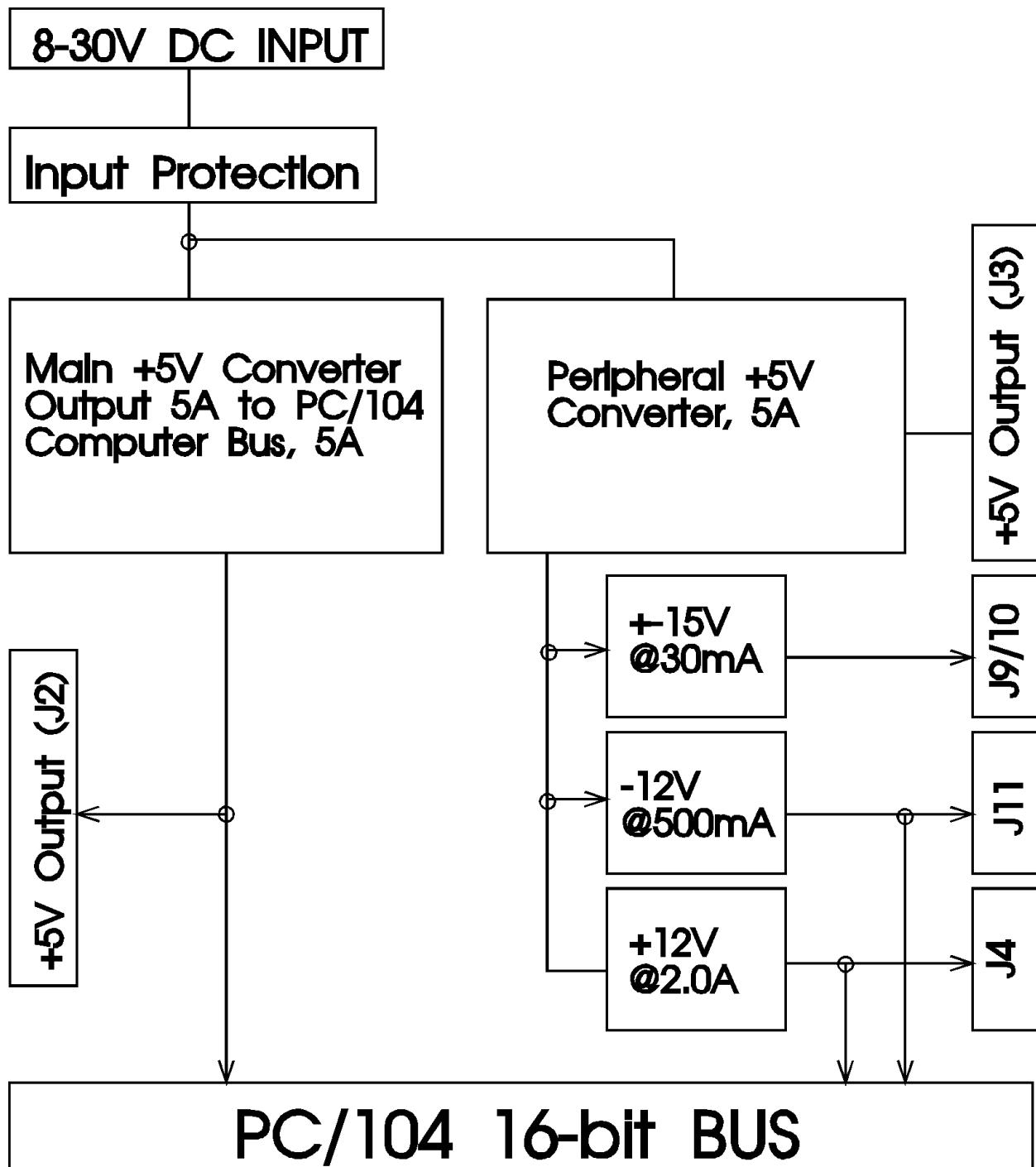


Fig. 2-1 Block diagram of the EPWR104HR-3 (The fuses and fan have been omitted for clarity).

Main +5V converter for computer

The main +5V output is implemented with a Step-down PWM, switch-mode DC-DC regulator. The output current of this unit is 5A. This converter has excellent dynamic and transient response capabilities making it ideal for high-speed computer power supplies. The output current is internally limited against over current and short circuit faults. The toroid-type inductor ensures high power density and low radiated noise.

The output of this converter is fused with a 5A thermal fuse on the -3 models. This will protect the unit from long lasting short circuit conditions. The input of this converter is protected with a 39V zener diode, a 39V transient absorber and a schottky diode. These devices are necessary to protect the input in automotive installations against overvoltage spikes and reverse voltage transients. These situations exist in vehicle systems that use electrically controlled hydraulic or pneumatic inductive valves. The main +5V converter feeds the PC/104 AT bus +5V pins with power. This power can be taken from the board from an external terminal block J2. (See previous section for location of J2.)

Secondary +5V, +-12V converter for peripherals

The peripheral +5V output is implemented with a Step-down PWM, switch-mode DC-DC regulator similar to the previous one. The output current of this unit is 5A. This power supply is independent from the main computer +5V source. 90% efficiency 5V to +-12V step up converters generates +-12V for peripheral devices such as EL- or TFT-panels, Hard drives, motors etc. The +12V output delivers 2,0A of current. This +12V supply also powers the PC/104 bus. The peripheral +5V power is available at terminal block J3 and the +-12V power at terminal block J4. (See previous section for location of J3/4.) Note: The onboard fan unit is powered from the +12V supply on -3 boards. In case of overload of +12V the onboard fan will not operate at full rated performance.

Auxiliary power outputs +-15V (+-12V) , -5V on -3 versions

The auxiliary power outputs +-15V(+-12V) and -12V are also generated from the peripheral +5V converter as is described in the block diagram on the previous page. The -12V converter is a 85% efficiency inverting +5V to -12V DC-DC converter. The output current of this stage is limited to 500mA with a current limiting circuit. This -12V supply also powers the PC/104 bus and is available from the terminal block J11. The dual output +-15V is generated using a miniature DC-DC converter module with an output power of 1W. This power may be used to power analog circuitry in the system. These outputs are only available from terminal blocks J9/J10. This +-15V output is not short circuit protected. The -5V converter is connected directly into the PC/104 bus and can be loaded up to 100mA.

Note: Upon request RTD can deliver units with other **customized output options** instead of +-15V.
Such configurations may include +24V, +48V or +-5V.

Onboard Status LED's

The EPWR104HR is equipped with 1-5 indicator LEDS. The function of the LEDS is described below (direction from PC/104 bus to board edge).

- L3 - Green. Indicates Computer +5V power converter is alive
- L4 - Green. Indicates Peripheral +5V power converter is alive
- L6 - Green. Indicates Peripheral +12V converter is alive
- L12 - Red. Indicates heater is on (LOW trip point reached)
- L1 - Red. Indicates fan is on (HIGH trip point reached)

Fan unit and thermostat (-3 only)

The EPWR104HR can be equipped with an optional onboard fan unit. This fan unit is powered from the onboard peripheral +12V supply. The fan is controlled with a thermostat chip. The thermostat unit has two independent outputs buffered with P-channel MOSFETS. Each of these trip point temperature levels can be set independently with trimpots. They are configured in such a way that the one toward the board will set the lower trip point and the one closer to the edge of the module will set the higher temperature trip point. Red LED's will indicate "trip point reached" condition. See figure 2-2 overleaf for a description of the thermostat operation.

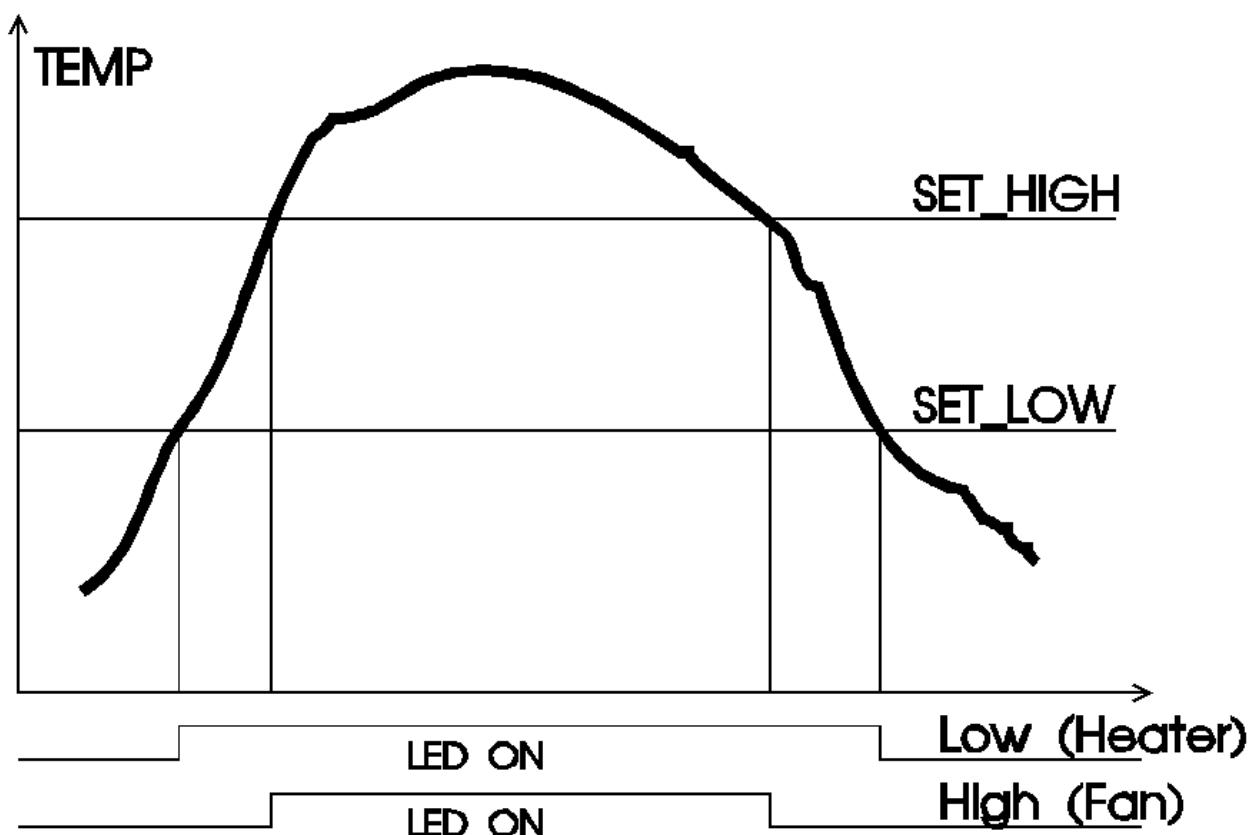


Fig. 2-2 Temperature thermostat operation

Header connector X4 can be used to drive an external cooling fan for the system. The fan + is connected to pin #2 (toward the mounting hole) and the fan - to pin #1 (toward the led array) of the header.

Note: The fan power consumption must be included in the total output power estimations.

To adjust the fan trip point temperature of the thermostat controller use the leftmost trimpot (one toward the middle of the board). Some useful application hints are included at the end of this chapter describing how to effectively use the thermostat and fan unit.

Fuses and protection

To protect your power supply from extensive long-term shorts the +5V DC/DC converters are internally thermally and overload protected. The +12V DC/DC converters are current limited and will tolerate continuous short circuit condition if they do not become overheated due to high ambient temperature.

The +12V converter is current limited to 2A and the -12V converter is current limited to 500mA. Outputs of all the +5V and the +12V converter outputs are zener diode protected; the +5V outputs with 3W 5.1V diodes and the +12V output with +13V zener diodes. These diodes protect your system from error conditions.

Output Power Calculations

The maximum available power for the peripheral power supply can be estimated using the following conservative formula:

(The output fuse of the Peripheral converter is 5A)

I1 = +12V output current

I2 = -12V output current

I3 = +5V output current

5A = (I1/0.88 + I2/0.82)*2,5 + 250mA +160mA (Onboard fan) +I3

(250mA is the maximum input power of the +-15V converter)

Note: Even though the total output power figure of 5A @5V is not exceeded, you must remember not to overload an individual output! Care must be taken not to thermally overload the unit. The maximum specified output power may not be available if the ambient temperature rises, and in this case additional heat sinking or additional airflow may be necessary.

The absolute maximum long-term output figures are:

+12V -> 2,5A

-12V -> 750mA

+15V -> +-30mA

-5V -> -100mA

+5V -> 5A

Application: Planar ICEBRITE panel interfacing

Planar ICEBRITE 640.480AM1 Power consumption	Pmax = 24W
	Ptyp = 11W

Connection to EPWR104HR:

Connect Panel +5V to Peripheral +5V supply
Connect Panel +12V to Peripheral +12V supply

The input power of the panel may vary greatly depending on the output pattern.

The maximum power consumption occurs with 50/50 2 x 2-checker board test picture.

Application: External heater and fan interfacing

Figure 2-3 shows a system with a heater unit and an external cooling fan.

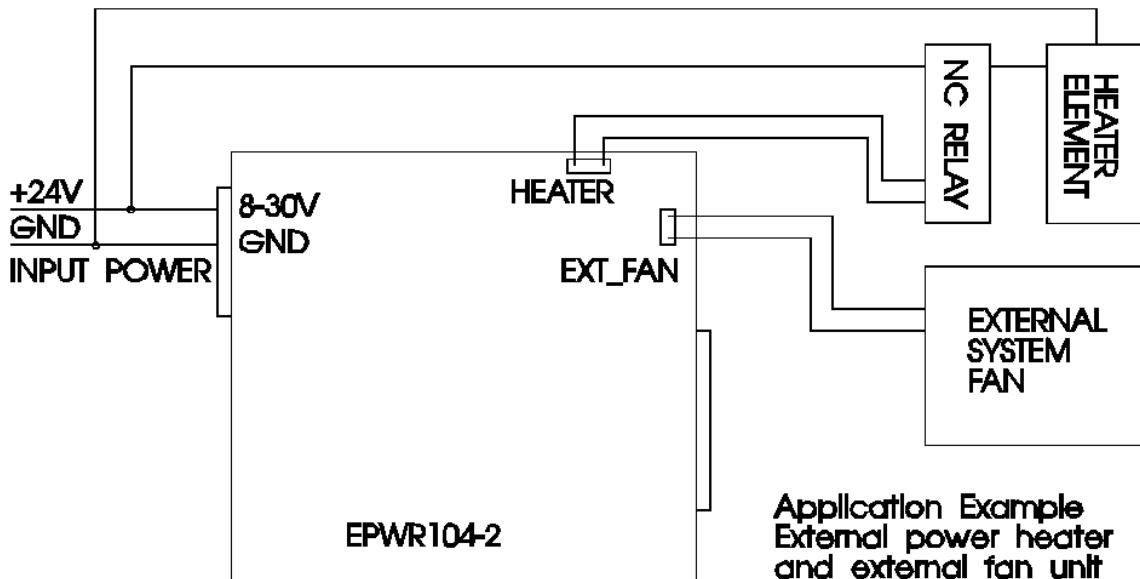


Fig. 2-3 System with heater unit and external system fan.

In this set up the external system fan is operated in parallel with the onboard fan unit .The trip point is adjusted with the "high" trimpot toward the middle of the board. The heater element derives its power from the raw power supply. This power is switched on and off by a relay (mechanical or solid state). Selection of the relay must be done according to the following criteria:

1. Primary 12V operation
2. Secondary contacts must withstand heater current
3. Function of the relay must be "normally closed" i.e the secondary contacts are closed when primary inactive

Such relays include:

Siemens SPCO type relay (6A contact rating)
V23092-A112V Farnell code: 959-340
Siemens SPCO type relay (8A contact rating)
V23061-B100X-A601 Farnell code: 910-764
OMRON SPCO type relay (20A contact rating)
G8H-1C4T-R Farnell code: 959-157
OMRON SPCO type relay (35A contact rating)
G8J-1C7T-R Farnell code: 959-133

Application: Two level fan control

Figure 2.4 overleaf shows a system with two independently configured external fan units.

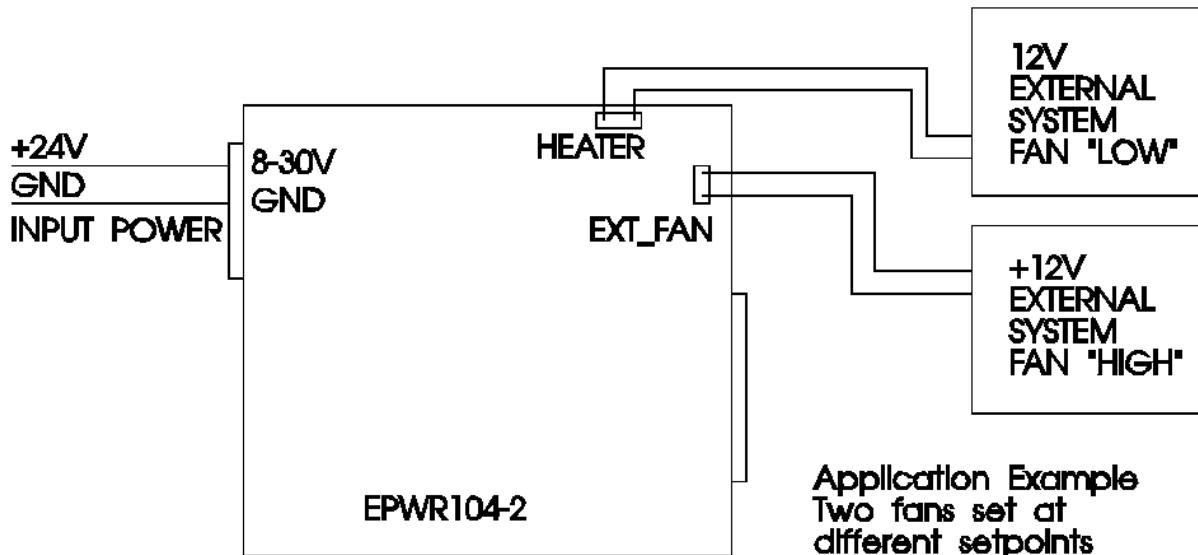


Fig. 2-4 Two level fan control

In this application it is possible to have two fans working in different temperature ranges as shown by the example below:

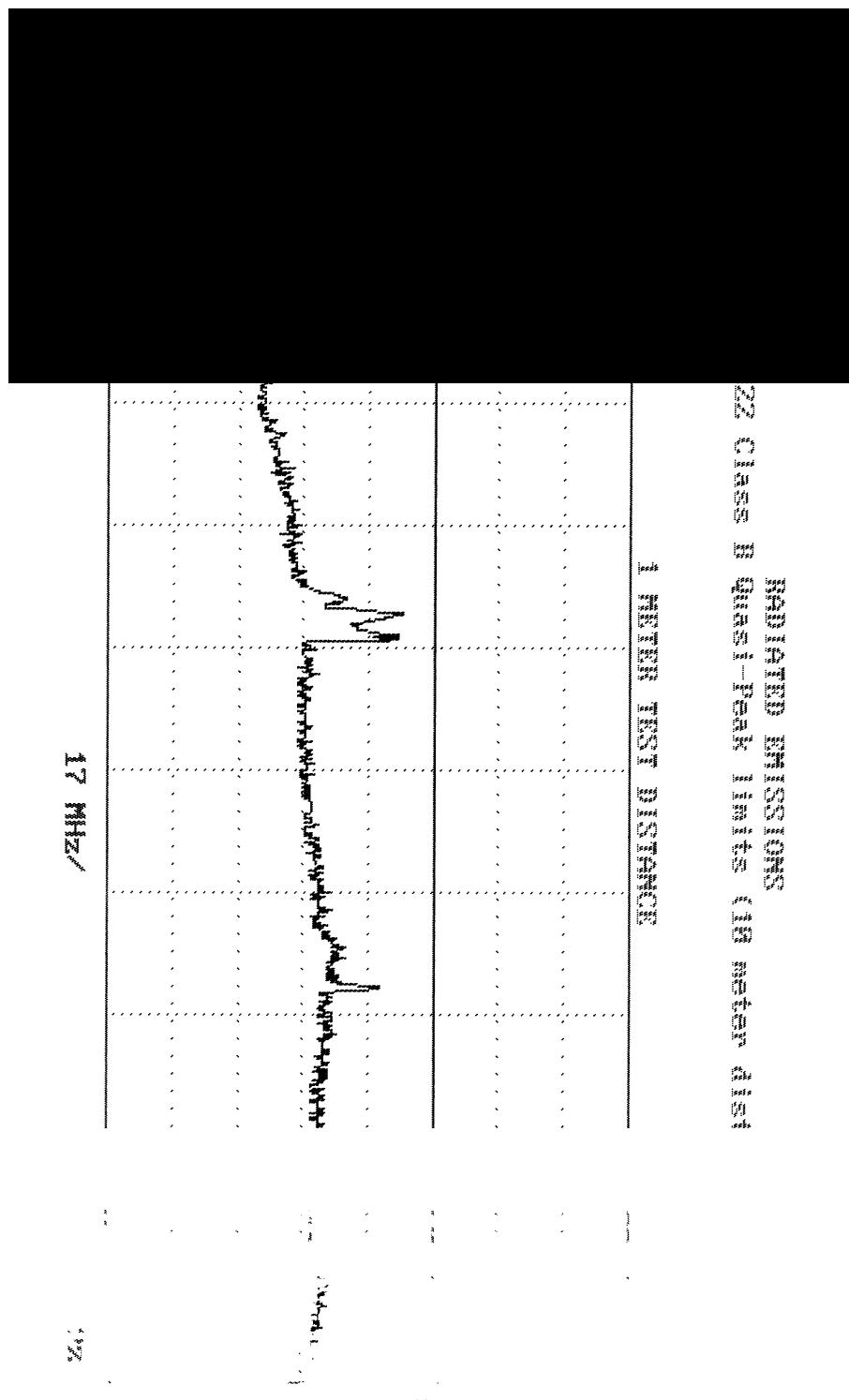
The "12V External system fan LOW" starts at a temperature of 40 degrees C if the temperature continues to rise to a level of 60 degrees C for example the "12V External system fan HIGH" will start. Now at temperature >60 C both units will work. This capability will free the hands of the system designer to implement flexible configurations for different environmental conditions.

Onboard filter/protection unit for CE compliance

Real Time Devices EPWR104HR boards features a special filter/protection module to meet the demands of the low voltage directives of CE compliance. The EMI filter is designed to reduce the characteristic noise of the EPWR104HR board in the frequency range of 30MHz to 1GHz. Also EPWR104HR features a transient voltage protection clamp against 2KV level voltage bursts commonly encountered in severe industrial or automotive applications. Measurements for the EPWR104HR for CE compliance have been performed using the IDAN enclosure, the RTD standard cable IDAN-XKCM18. On the next page is a diagram on the test results of the EN55022-B emission tests for the IDAN-EPWR104HR.

Application: 24V AC input for the EPWR104HR

You may use the EPWR104HR from an AC input of 24V; 50/60Hz. In this case you should use a full bridge rectifier designed from discrete Schottky diodes such as the 90SQ040, this full wave rectified input voltage is 28V DC.



Chapter 4 EPWR104HR SPECIFICATIONS

Host Interface

16-bit PC/104 bus

Power supply specifications

Input voltage range (A high voltage variant is also available, please consult RTD)	8-40V DC Absolute maximum
Output Power (50W total)	+5V@ 5A - Computer +5V@ 5A - Peripherals +12V@ 2,5A -12V@ 750mA +15V@ 30mA –3 version -5V@ 100mA –3 version
Minimum efficiency (conservative estimate)	82%
Output voltage unloaded	Vnom +4,98V - +5,01V
Output voltage fully loaded	Vnom. - 0,08V (min@5A)
Fan power consumption	+12V@160mA (max)
Fan control	Thermostat
Fan airflow	1,6L/min (Min)

Connectors

Power connectors	Phoenix Contact Combicon Series "mini-floppy connector" AT PC/104 bus
Host bus (Optionally no bus connector)	

Electromechanical

EMC Characteristics CE-compliance	Meets EN55022 CIS-B emission levels Compliant in IDAN-EPWR104HR configuration with IDAN-XKCM18 cable
Operating temperature range Power dissipation Heat sink material	-40 to +85C 8,1W (Max) Aluminum, 1 mm thick material

Chapter 5 RETURN POLICY AND WARRANTY

Return Policy

If the module requires repair, you may return it to us by following the procedure listed below:

Caution: Failure to follow this return procedure will *almost always* delay repair! Please help us expedite your repair by following this procedure.

- 1) Read the limited warranty, which follows.
- 2) Contact the factory and request a Returned Merchandise Authorization (RMA) number.
- 3) On a sheet of paper, write the name, phone number, and fax number of a technically competent person who can answer questions about the problem.
- 4) On the paper, write a detailed description of the problem with the product. Answer the following questions:
 - Did the product ever work in your application?
 - What other devices were connected to the product?
 - How was power supplied to the product?
 - What features did and did not work?
 - What was being done when the product failed?
 - What were environmental conditions when the product failed?
- 5) Indicate the method we should use to ship the product back to you.
 - We will return warranty repairs by UPS Ground at our expense.
 - Warranty repairs may be returned by a faster service at your expense.
 - Non-warranty repairs will be returned by UPS Ground or the method you select, and will be billed to you.
- 6) Clearly specify the address to which we should return the product when repaired.
- 7) Enclose the paper with the product being returned.
- 8) Carefully package the product to be returned *using anti-static packaging!* We will not be responsible for products damaged in transit for repair.
- 7) Write the RMA number on the outside of the package.
- 8) Ship the package to:

Real Time Devices Finland Oy

Lepolantie 14

FIN-00660 Helsinki

FINLAND

Limited Warranty

Real Time Devices, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from REAL TIME DEVICES. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, REAL TIME DEVICES will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to REAL TIME DEVICES. All replaced parts and products become the property of REAL TIME DEVICES. Before returning any product for repair, customers are required to contact the factory for an RMA number.

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